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[54] **LASER PULSE EXTENDER**

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[52] **U.S. Cl.** **372/108**; 372/99; 372/98; 372/100; 372/92; 372/700

[58] **Field of Search** 372/99, 98, 700, 372/92, 100, 107, 108

[56] **References Cited**

U.S. PATENT DOCUMENTS

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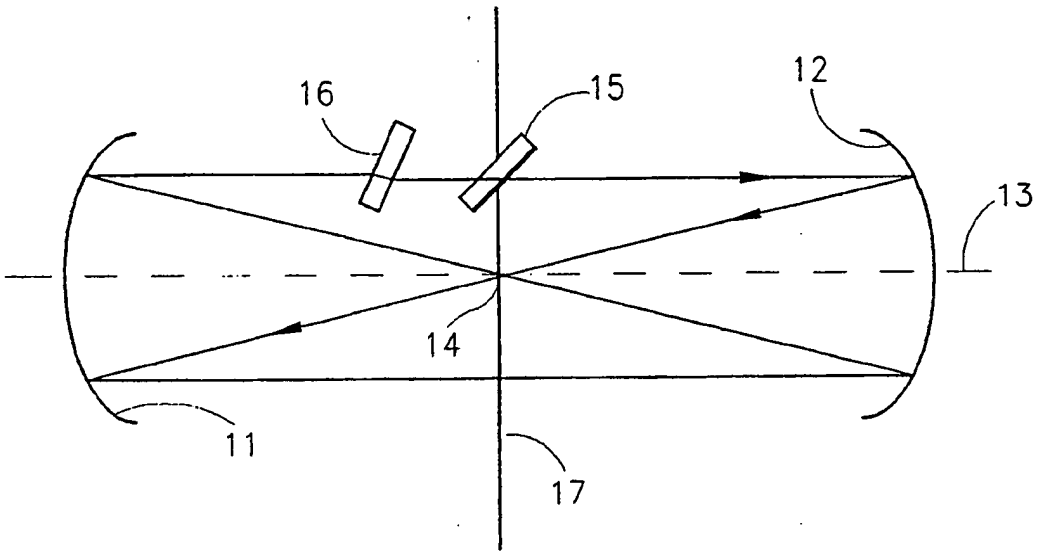
[57] **ABSTRACT**

A device for extending the duration of a light pulse by a factor of an integer or by a factor which differs from an integer. The light pulse is passed through a device which divides the initial beam into a number of parts, where the first part passes unhindered while the subsequent parts of the beam are retarded and pass through the system after various delay periods, resulting in the desired extension of the pulse duration. The basic components of the novel device are spherical mirrors facing each other, a special reflector and a translation plate.

6 Claims, 5 Drawing Sheets



In this realisation we ignore translation due to the reflector thickness and the entire translation is done by the plate. If we use the same design of plate we will have to tilt it 30.7° to get the required translation.

It is possible to design a device according to the present invention by means of which it is possible to extend the pulse duration by a factor different from an integer. The following describes how to extend pulse druation by a factor of 1.5 times, and this illustrates how such extension can be made by any desired factor.

There exist practically two functions, the first of which determines the energy ratios and here the determining factor is the special reflector; the second is determined by the time delay and this is a function of the distance between the two curved reflectors (spherical, parabolic) which face each other.

For example, for a pulse extension by a factor of 1.5 there may be used, amongst others, two following systems:

a. To use a reflector of the type used for a 2-times pulse extender, but to fix the mirrors at a distance which correspnds to a delay of half the pulse width, and thus half the energy will exit immediately and the other half will be delayed by half a pulse width at the exit. This is illustrated with reference to FIG. 3 which shows the energy distribution at various stages of the transmission of a pulse.

b. Another possibility of pulse extension by a factor of 1.5 times is to use a special reflector which will allow an initial passage of two thirds of the pulse energy and after the delay, passage of the residual energy.

This illustrates the principle of pulse extenders by a factor which differs from an integer.

We claim:

1. Apparatus for extending the duration of a light pulse, comprising:

two spherical reflectors facing each other with a common optical axis;

a reflector divided into a sequence of transparent elements and reflecting elements parallel with each other, placed at a 45°-angle with an optical axis; and,

a translation plate at an angle with said reflector for providing a desired translation vertical with respect to a common optical axis, for each passage of a part of a light beam, so that part of the light beam, incident upon said reflector at an angle of 90° with the optical axis, passes through said reflector without hindrance, while part of the light beam passes at least once between said spherical reflectors, which are located at a distance from each other resulting in a light path having a length which causes a time delay, before exiting in the same direction as its entry after said time delay, said reflector being larger than the cross-section of the light beam and with said reflector being placed in the path of an entering light beam, and with said translation plate placed in the path of a parallel beam, thereby extending the duration of a light pulse.

2. The apparatus for extending the duration of a light pulse according to claim 1, wherein said reflector comprises a sequence of transparent parallel bands and between the sequence of transparent parallel bands is a sequence of reflective bands, wherein the width of the reflective bands is a fixed multiple of that of the sequence of transparent parallel bands.

3. The apparatus for extending the duration of a light pulse according to claim 2, wherein the ratio between the widths of the transparent parallel bands to the reflective bands is 1:2, 1:3, 1:4 or greater.

4. The apparatus for extending the duration of a light pulse according to claim 1, wherein said translation plate is dimensioned and oriented so that said translation plate produces a translation of the light beam with respect to the optical axis of said two spherical reflectors by the width of stripes of said transparent elements or said reflecting elements of said reflector.

5. The apparatus for extending the duration of a light pulse according to claim 1, wherein said reflecting elements are reflecting bands on a transparent substrate.

6. The apparatus for extending the duration of a light pulse according to claim 1, wherein said reflecting elements are reflective prisms.

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